

# CHAPTER 1

## INTRODUCTION

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### 1-1. GENERAL.

This manual describes the operation and Organizational Maintenance, including components and parts lists, for the Precision Gunnery System (PGS) used on the Light Armored Vehicle (LAV).

### 1-2. MAINTENANCE FORMS AND PROCEDURES.

Forms and procedures used for equipment are those prescribed in TM 4700-15/1, *Ground Equipment Record Procedures*.

### 1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs).

Let us know if your PGS needs improvement. Send us an equipment improvement recommendation (EIR). As the user, you are the only one who can tell us what you don't like about the equipment. If there is a problem with design or performance, put your comments on an SF 368, Product Quality Deficiency Report. Mail it to: Commander, Code SST, MARCORSYSCOM, 3095 Roan Street, Quantico, VA 22134-5010. A reply will be sent to you.

### 1-4. LIST OF ABBREVIATIONS.

#### NOTE

Refer to paragraph 1-11 for an explanation of abbreviations displayed on PGS control panel.

AAR . . . . . After Action Review  
 BIT . . . . . Built-In Test

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## 1-4. LIST OF ABBREVIATIONS (Con't).

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CAN	Controller Area Network
CB	Circuit Breaker
CDA	Control Display Assembly
CGUN	Control Gun
CLS	Contractor Logistics Support
CP	Control Panel
EIR	Equipment Improvement Recommendation
EXP. U	Expansion Unit
FCS	Fire Control System
HIRE (DIM36TH)	Hughes Infrared Equipment
HDDU	Hull Defilade Detector Unit
LAV	Light Armored Vehicle
L/F	Left Front
L/R	Left Rear
LTID	Laser Target Interface Device
MILES	Multiple Integrated Laser Engagement System
PDA	Power Distribution Assembly
PGS	Precision Gunnery System
RDU	Retro Detector Unit
R/F	Right Front
R/R	Right Rear
RSI	Remote System Interface
TAMMS	The Army Maintenance Management System
TAVSC	Training Audio Visual Support Center
TBOS	Tracer, Burst, Obscuration Simulator
TBOS-DUD	Tracer, Burst, Obscuration Simulator - Driver Unit - Dual
TBOS-EU	Tracer, Burst, Obscuration Simulator - Eyepiece Unit
TBOS-VM	Tracer, Burst, Obscuration Simulator - Video Mixer
TCU	Target Computer Unit
TDRS	Training Data Retrieval System
TS	Target System
TU	Transceiver Unit
TWGSS	Tank Weapon Gunnery Simulation System
VIU	Vehicle Interface Unit

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## 1-5. EQUIPMENT DESCRIPTION.

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a. **Purpose of PGS.** The PGS is a vehicle-mounted training device that assists the LAV crew in gaining and improving proficiency in gunnery skills without the expenditure of live ammunition. Gunnery and tactical training can be conducted anywhere that eye-safe laser firing is permitted. PGS provides the crew with visual and sound effects to accurately simulate real firing conditions.

b. **Functional Configuration.** The PGS simulates the firing of the LAV's 25 mm gun, the firing of the coaxially-mounted machine gun, and the effects of a target vehicle being hit. The PGS consists of three sub-systems: firing system, target system, and Training Data Retrieval System (TDRS).

(1) **Firing System.** PGS simulates the firing ballistic characteristics of ammunition and the visual and sound effects of firing.

## 1-5. EQUIPMENT DESCRIPTION (Con't).

(2) **Target System.** The target system receives firing information from an attacking weapon, equipped with a laser training device, and notifies the crew of the effects of the attack. The attack could come from another PGS-equipped vehicle, a Tank Weapon Gunnery Simulation System (TWGSS)-equipped tank, or a Multiple Integrated Laser Engagement System (MILES)-equipped unit. An instructor using the control gun (CGUN) can also communicate with the PGS target system.

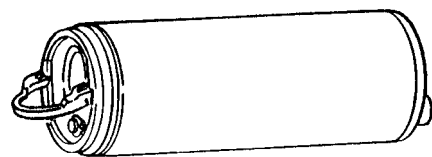
(3) **TDRS.** The TDRS is used to evaluate the effectiveness of the firing engagements whether in a precision gunnery exercise or a tactical training environment. The TDRS provides real time analysis for each round fired and engagement undertaken. For more information on TDRS, refer to TM 9-6920-711-12&P-1.

### c. Features and Capabilities.

- (1) Simulates vehicle firing and ammunition effect on targets.
- (2) Provides full fire control interface to enable the vehicle crew to train using normal engagement techniques.
- (3) Provides training capabilities utilizing Class 3A (conditionally eye safe) eye-safe laser.
- (4) Interoperable and compatible with TWGSS, MILES, and Laser Target Interface Devices (LTIDs).
- (5) Provides panel gunnery training, target tracking training, ½ scale target capability, 1/10 scale target capability, and combat training in a realistic environment with immediate feedback.
- (6) Simulates the visual effects of the 25 mm gun and coaxially-mounted machine gun. These simulations include tracer, tracer burst on target, and burst on ground.
- (7) Provides firing sound effects over vehicle intercom. These sound effects include:
  - (a) 25 mm gunfire signature
  - (b) Coax gunfire signature
  - (c) Hit indication
  - (d) System error indication
- (8) Provides and stores continuously updated vehicle position and time data.

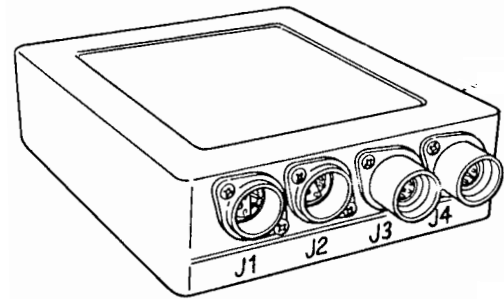
### d. Description of Major Components.

(1) **Transceiver Unit.** Performs the complete weapon effect simulation. The unit is pre-programmed with the physical and operational characteristics of the weapon it is simulating and utilizes lasers to transmit pulses and receive reflections from the targets. The unit determines the target position from the laser pulses and transmits the point of impact, type of ammunition, and identity of attacker to the target. MILES information is also transmitted in order for MILES-equipped target systems to respond.

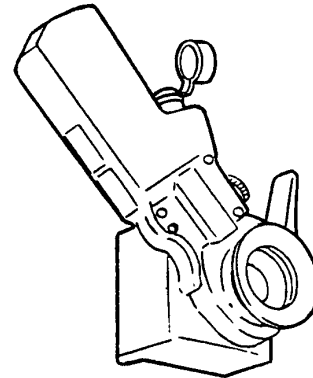


## 1-5. EQUIPMENT DESCRIPTION (Con't).

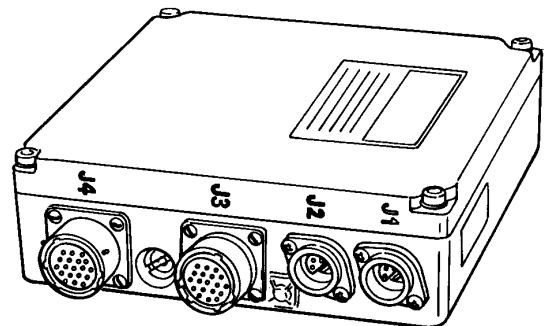
(2) **Tracer, Burst, Obscuration Simulator (TBOS) Driver Unit.** Provides tracer and burst effects simulation into the gunner's and commander's TBOS eyepiece units.



(3) **TBOS Eyepiece Unit.** Provides tracer and burst effects simulation into the gunner's and commander's day sight pictures.



(4) **Target Computer Unit.** Receives results of a simulated firing, including hit point, type of ammunition, and identity of attacker. The unit compares this information with the type of target it is programmed to simulate, its size and vulnerability, and determines if there was a near miss, hit, mobility kill, weapon kill, catastrophic kill, or no effect. The target system is also programmed to detect firing from MILES-equipped firing systems.

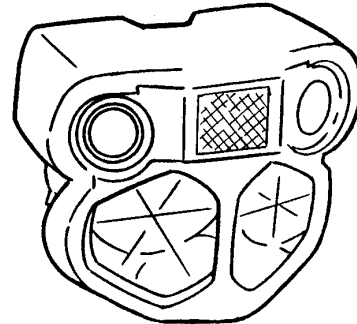


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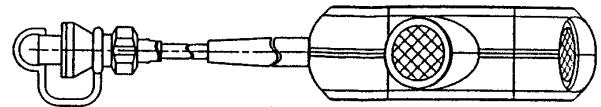
**1-5. EQUIPMENT DESCRIPTION (Con't).**

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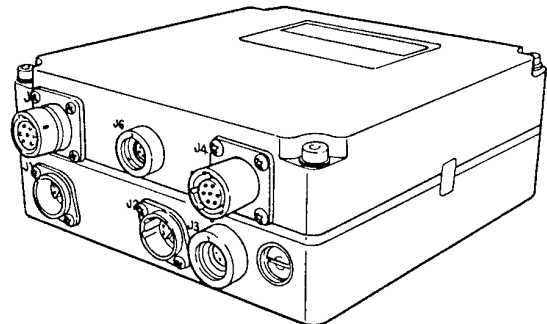
(5) **Retro Detector Unit.** Consists of two reflectors, two laser detectors, and one strobe light. The reflectors reflect laser pulses back to the attacking PGS, TWGSS, or MILES. The laser detectors receive hit information, including type of ammunition, identity of attacker, and hit point from attacking PGS or TWGSS. The strobe light flashes when a vehicle has been hit. Four units are placed on the turret to provide 360 degrees of coverage.



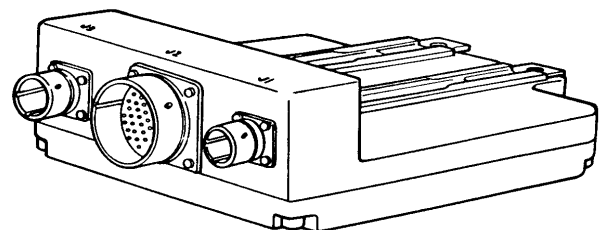
(6) **Hull Defilade Detector Unit.** Senses hit to hull, when hull of vehicle is exposed. Four units are placed low on the turret to provide 360 degrees of coverage.



(7) **Vehicle Interface Unit.** Receives electrical power from the vehicle and distributes power to system components.



(8) **Expansion Unit.** Receives information from the vehicle regarding turret position and vehicle fire control system status. Receives and sends signals to vehicle fire control system, and provides this information to the vehicle interface unit. Also provides audio indications to vehicle intercom.

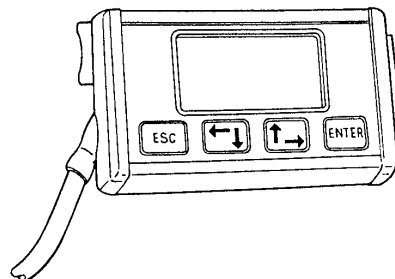


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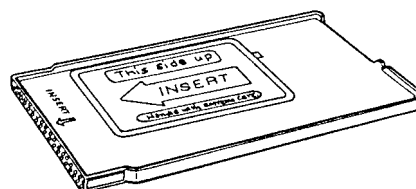
**1-5. EQUIPMENT DESCRIPTION (Con't).**


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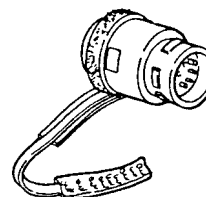
(9) **Control Panel.** Provides the means to manually input required system functions, subfunctions, and options; upload ammo; select training modes; operate system during training; align system prior to training; and view results of firing simulations and built-in test (BIT) error messages.



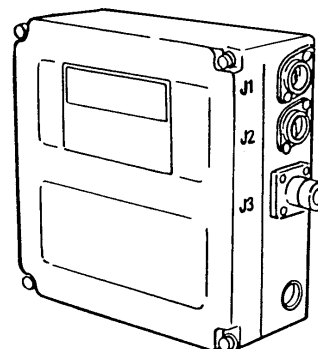
(10) **TDRS Memory Card.** Stores firing and target vehicle application data needed for intended training exercise. Collects and stores exercise events during PGS training. The stored training exercise events can be retrieved for After Action Review (AAR) with the TDRS computer unit.



(11) **Shorting Plug.** Provides a simulated firing of 25 mm gun by isolating the 25 mm gun from its firing circuits.



(12) **Remote System Interface (RSI) Unit.** Receives satellite signals that continuously calculate vehicle position. Provides a means to view and store the vehicle position during a training exercise. The stored vehicle position(s) and time data can be retrieved for AAR with the TDRS computer unit.

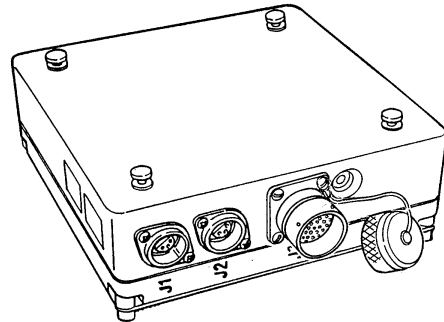


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## 1-5. EQUIPMENT DESCRIPTION (Con't).

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(13) **TBOS Video Mixer.** Mixes video-generated tracer dot and burst effects images into DIM36TH sights.



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## 1-6. EQUIPMENT LIMITATIONS.

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This paragraph is not applicable.

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## 1-7. OPERATION OF PGS WITH DEGRADED VEHICLE SYSTEM.

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Operation of the PGS with a degraded vehicle gunnery system is possible as PGS includes its own sensors. Neither the gunner nor commander are required to enter any prompting data or adjustments to the simulator during simulated firing exercise. The PGS determines the projectile flight path from the gun axis and firing tables and is stabilized during time of flight by internal gyros.

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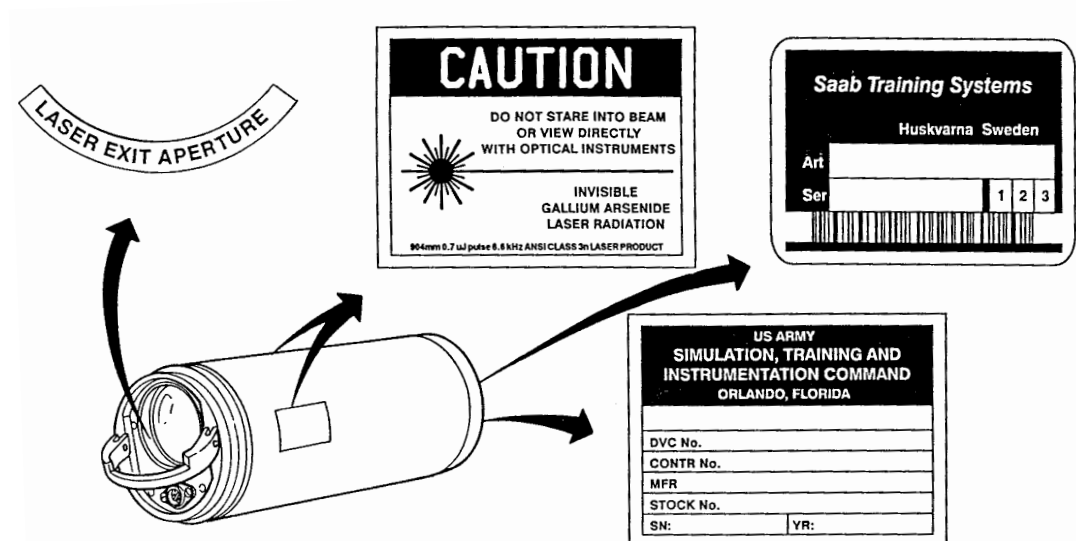
## 1-8. MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM.

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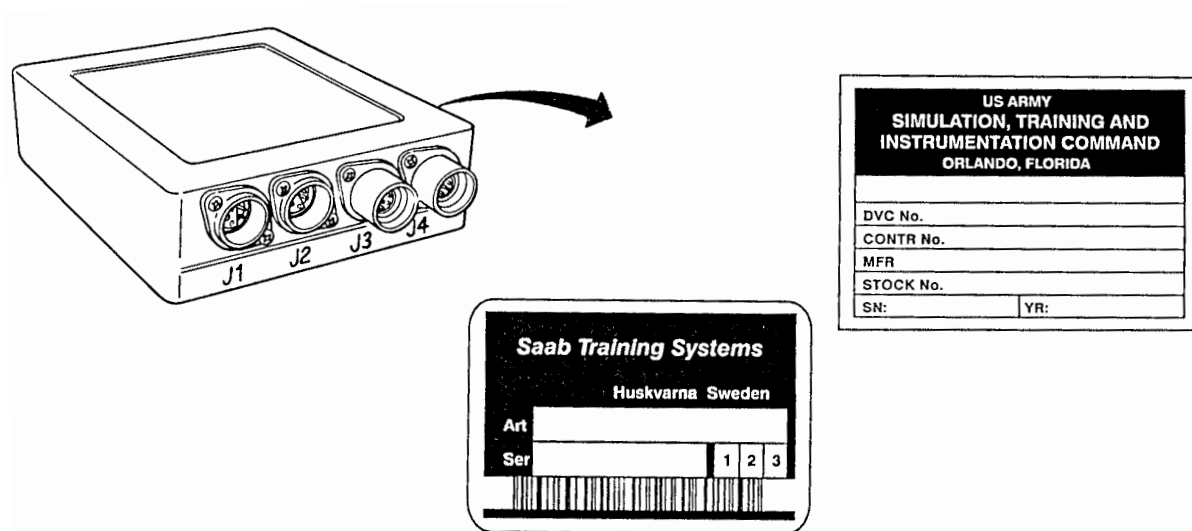
- a. **TDRS Computer Unit.** Used with TDRS memory card. Allows training controller/crew to view and store results of training exercise. The computer is also used to program memory cards prior to training.
- b. **CGUN.** Provides electronic access to PGS. Allows training controller access to certain operation modes on the control panel.
- c. **MILES.** Provides interactive training between PGS and MILES during combat training exercises.
- d. **LTID.** Used in conjunction with panel target operating systems to lower target during panel gunnery training.
- e. **Retro Reflector Unit.** Provides a detectable laser beam back to the firing vehicle. This enables the firing vehicle to determine the range-to-target and perform system alignment procedures.

## 1-9. LOCATION AND DESCRIPTION OF DECALS.

### a. Transceiver Unit.



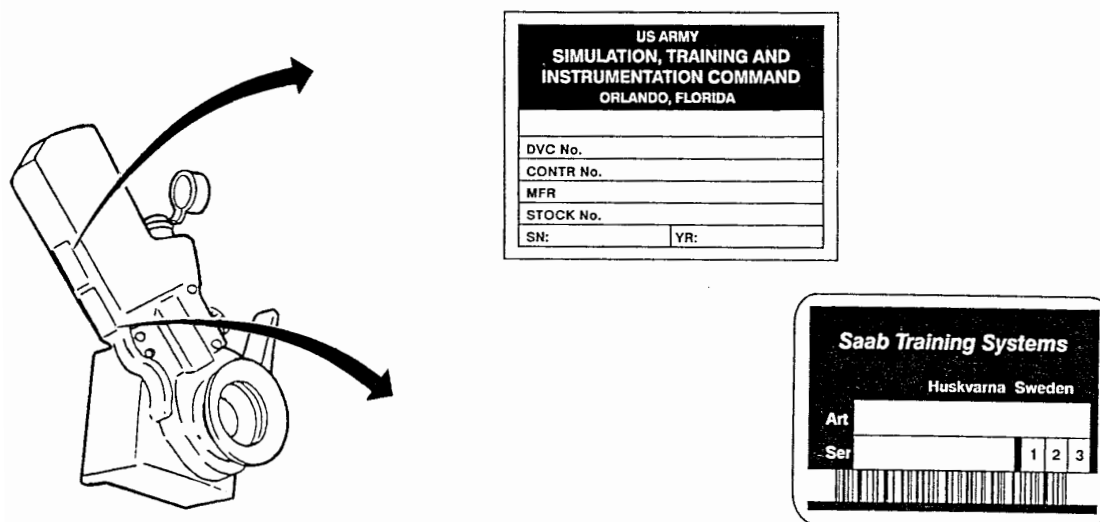
### b. TBOS Driver Unit.



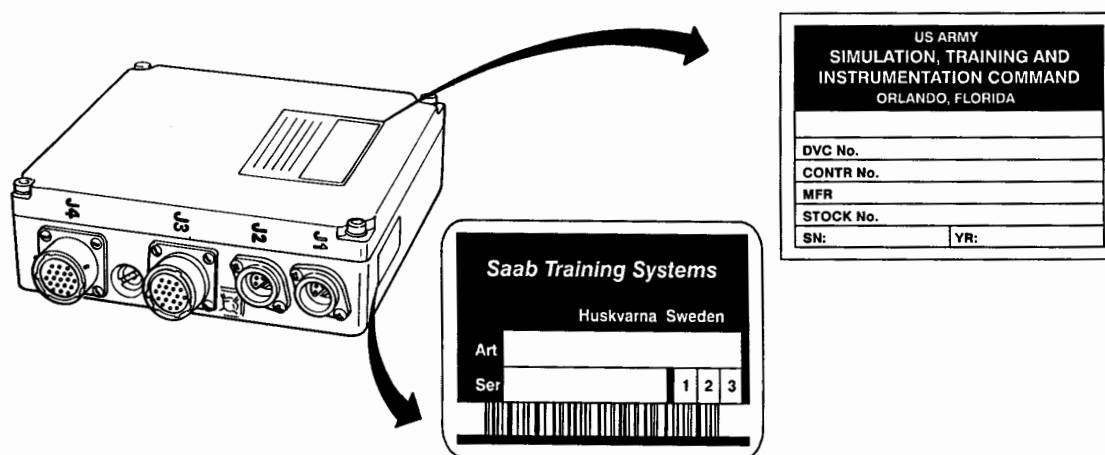


# 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

## c. TBOS Eyepiece Unit.

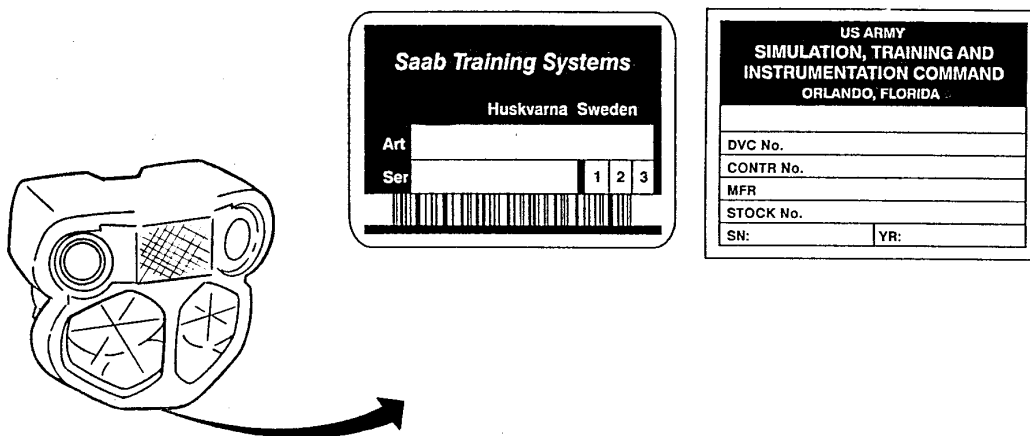


## d. Target Computer Unit.

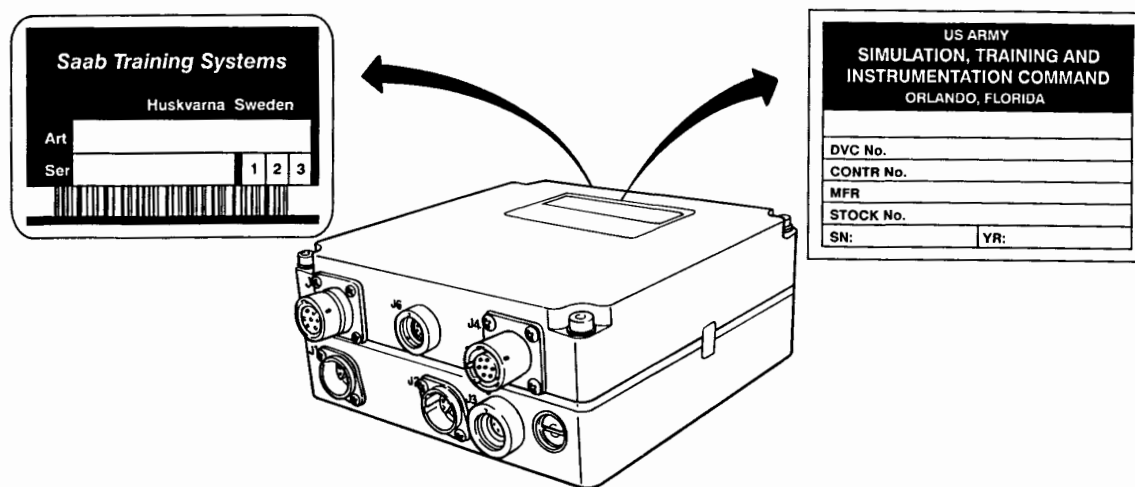


# 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

## e. Retro Detector Unit.

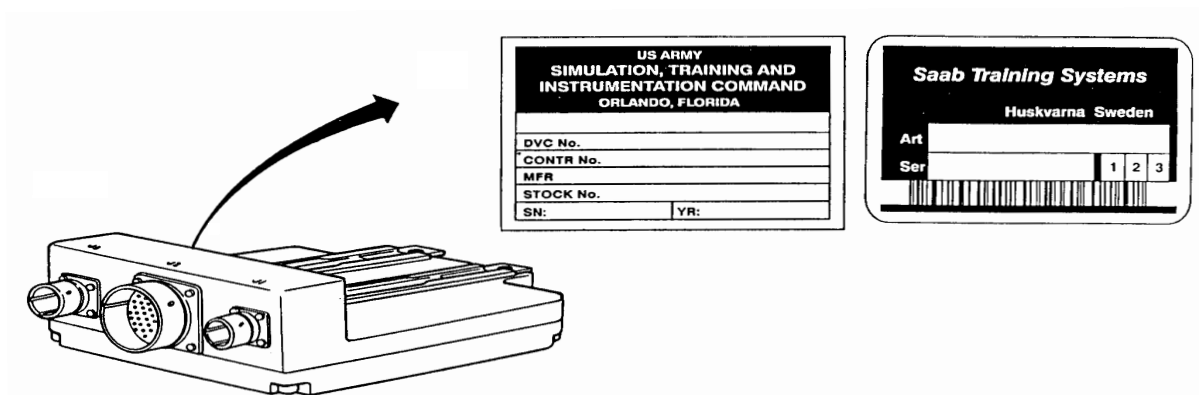


## f. Vehicle Interface Unit.

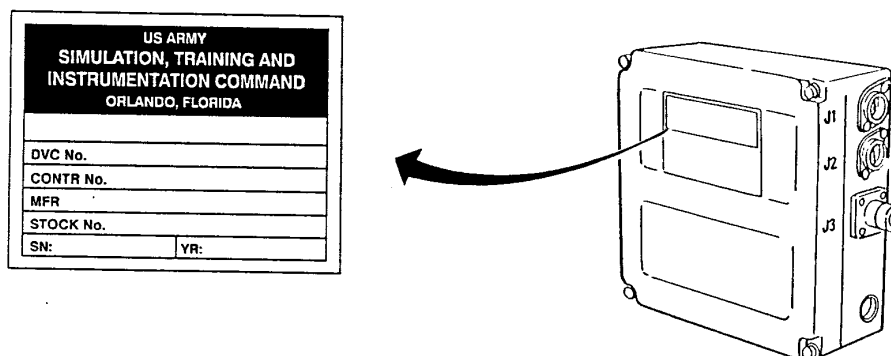


## 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

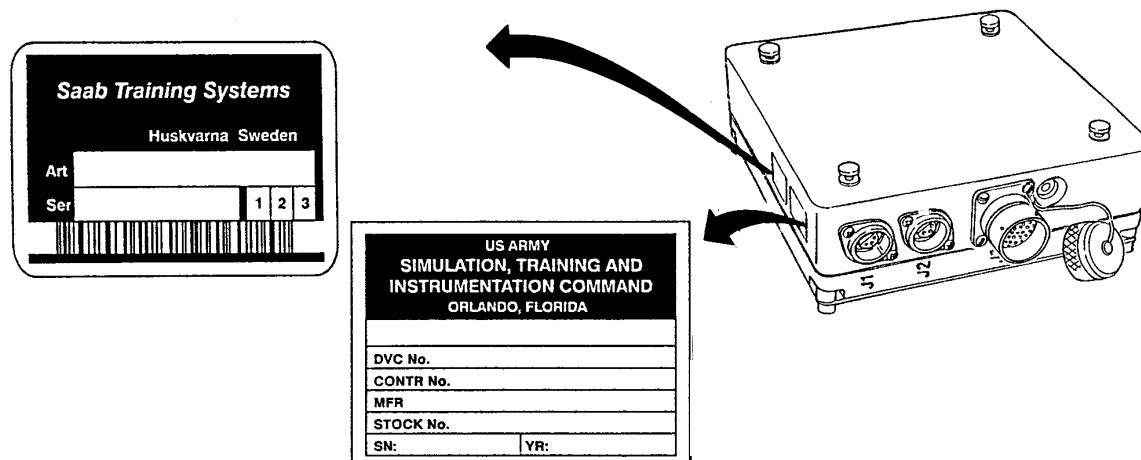
### g. Expansion Unit.



### h. Remote System Interface Unit.

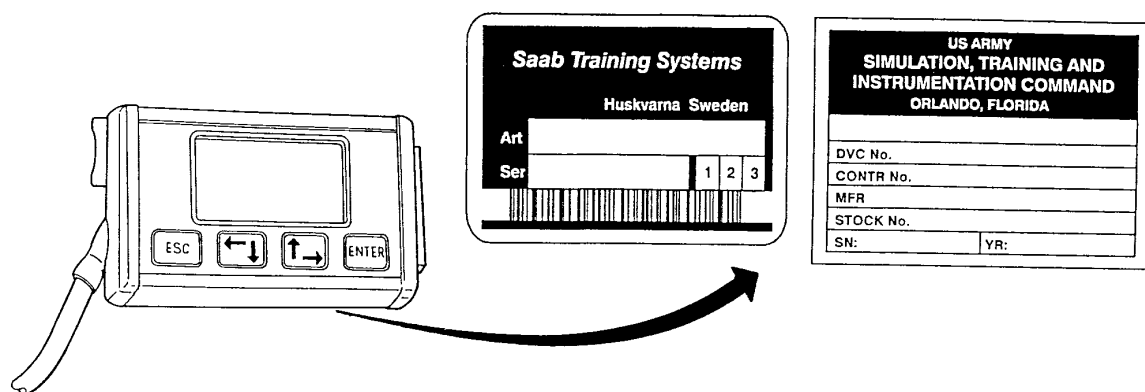


### i. TBOS Video Mixer Unit.

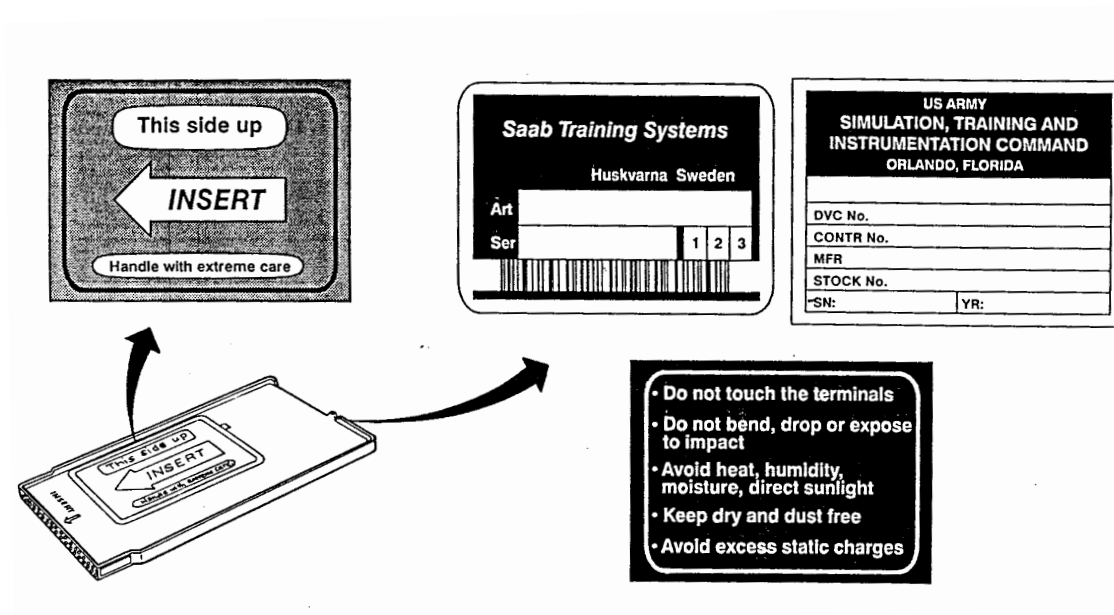


## 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

### j. Control Panel.



### k. TDRS Memory Card.

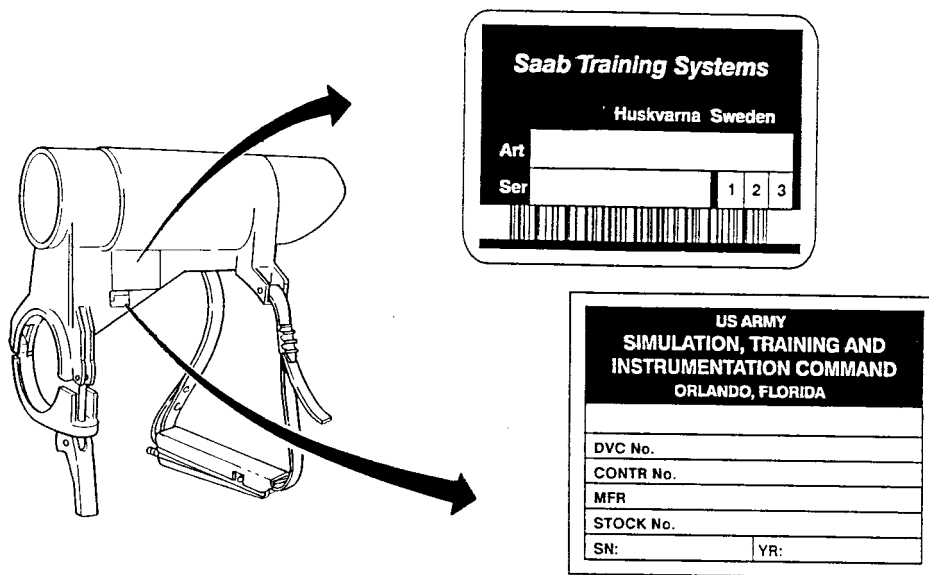


## 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

### l. Shorting Plug.

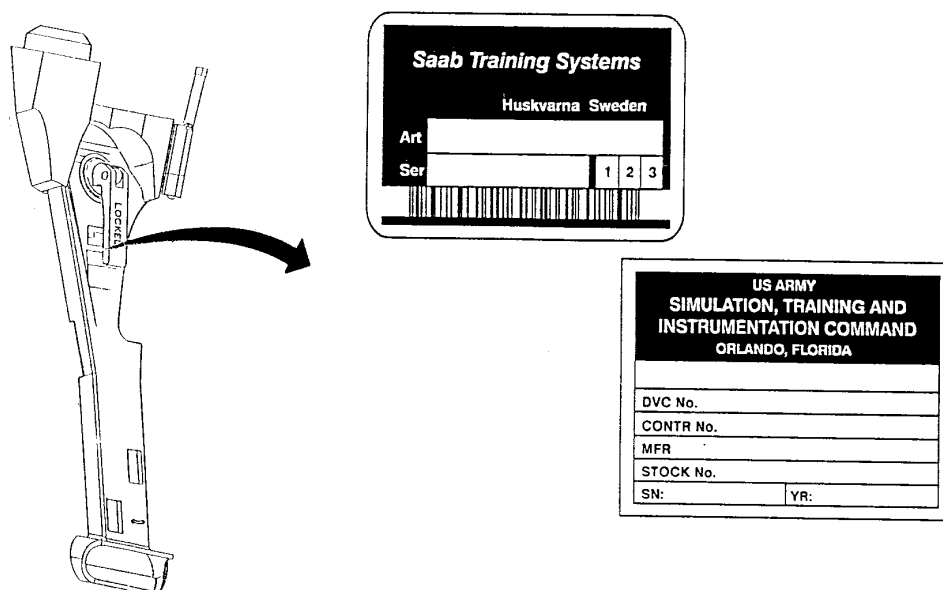


### m. Transceiver Unit Bracket.

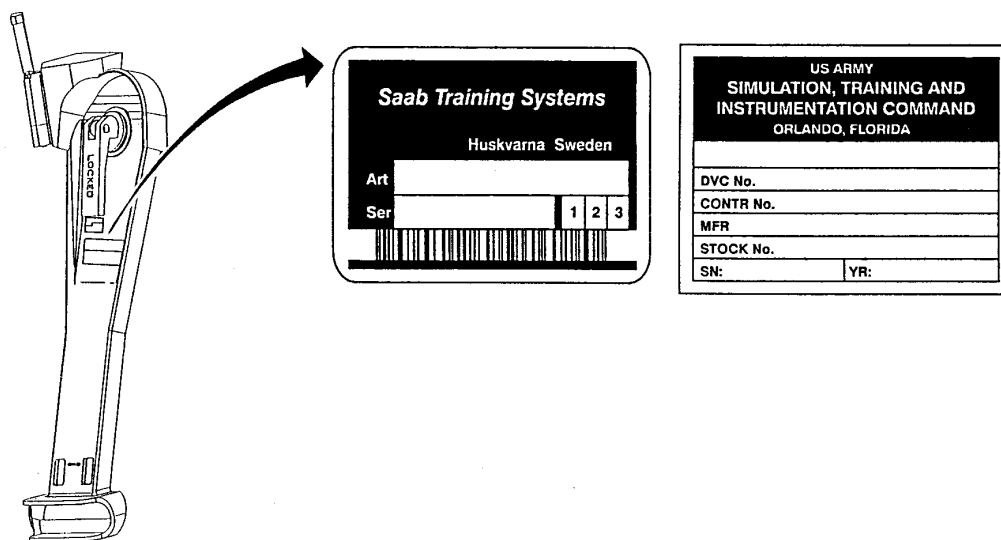


## 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

- n. Retro Detector/Hull Defilade Detector Assembly Bracket (Right-Front).

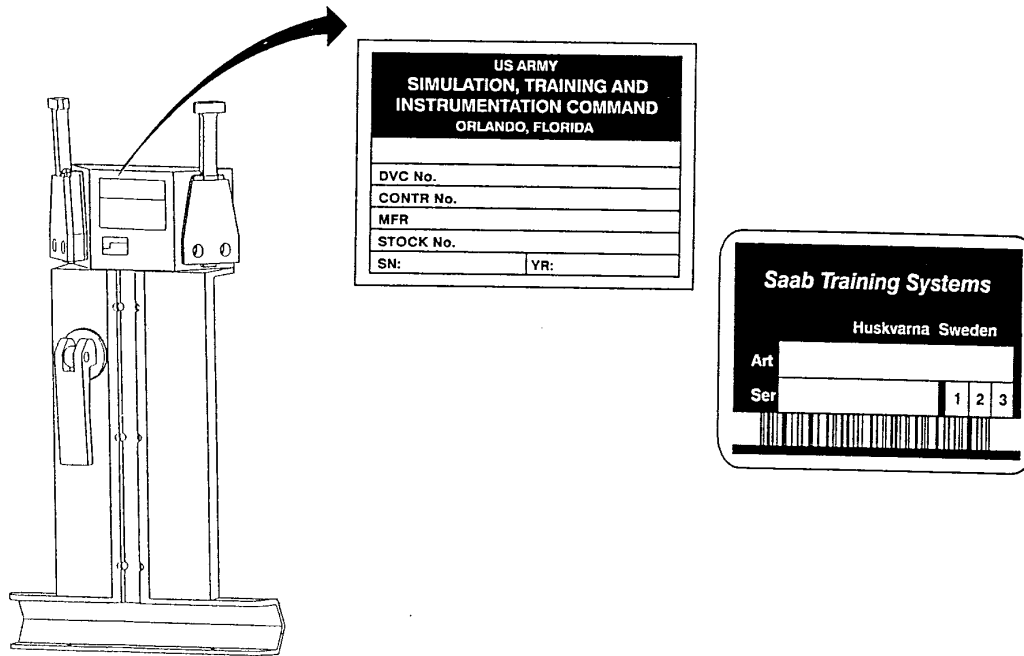


- o. Retro Detector/Hull Defilade Detector Assembly Bracket (Left-Front).

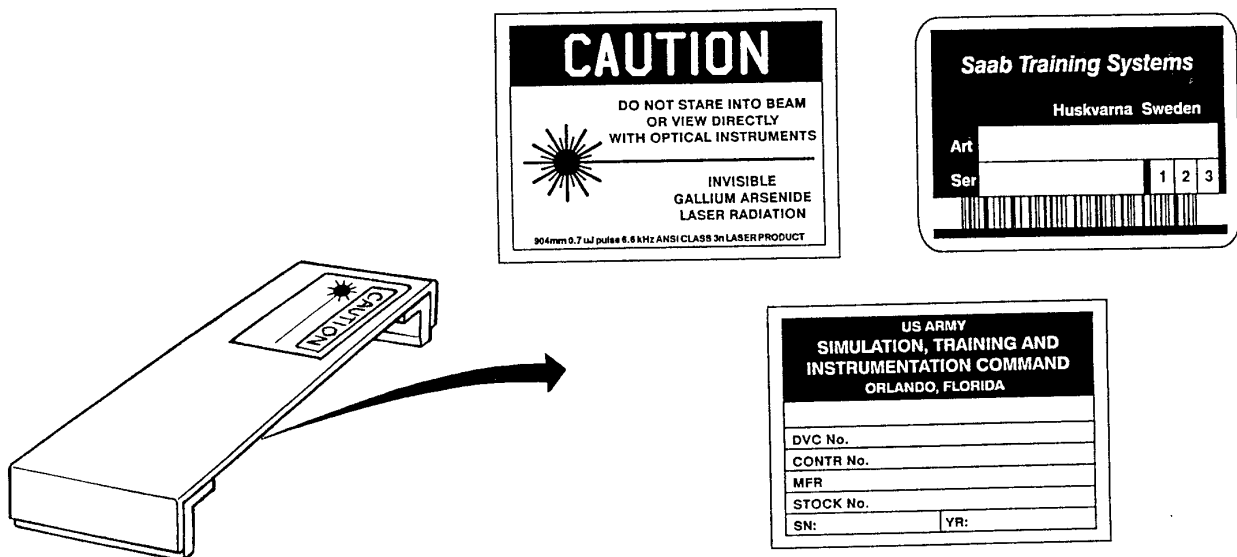


# 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

p. Rear Retro Detector/Hull Defilade Detector Assembly Bracket.

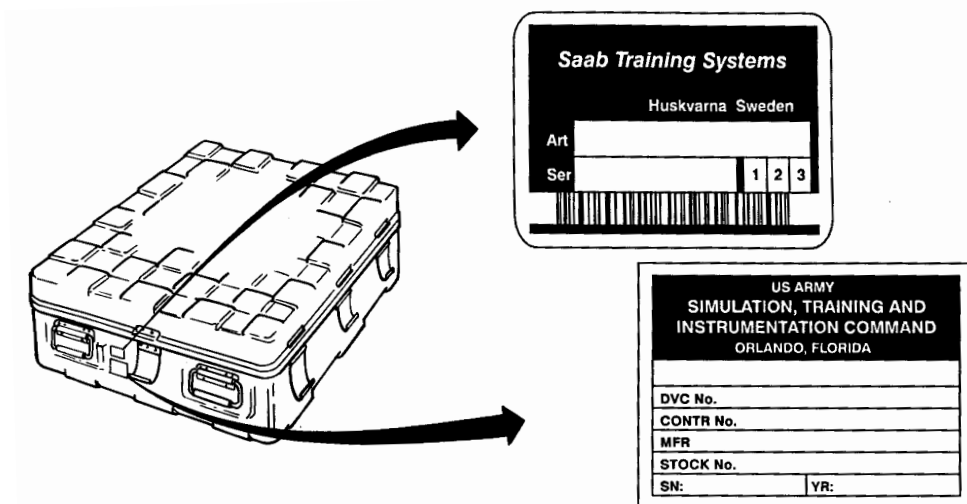


q. Control Panel Bracket.

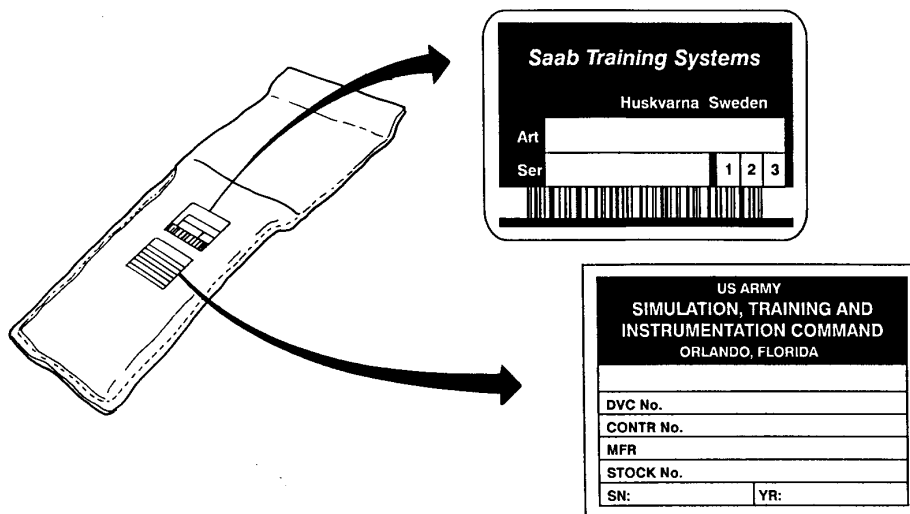


## 1-9. LOCATION AND DESCRIPTION OF DECALS (Con't).

### r. Storage Cases.



### s. TDRS Memory Card Pouch.





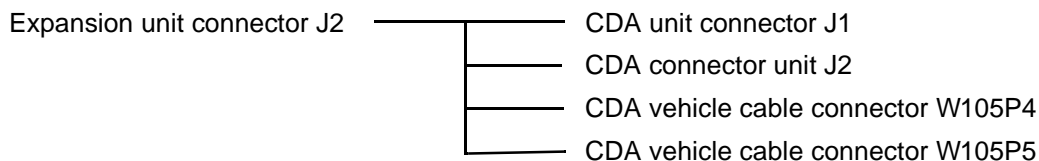
## 1-10. IDENTIFICATION OF CABLES AND CABLE CONNECTORS.

a. **General.** PGS cables are provided with identification bands at the approximate center (where possible) of each length of cable. Identification bands are flexible plastic tubes that surround each cable and are of a color that contrasts with the cable color. Bands are numbered from W-1 through W-14. The PGS cables are also provided with an identification band at each cable end. These identify the connector of the cable and the connecting point for that connector. Connectors are typically numbered from J-1 through J-4.

- [illegible]

## 1-10. IDENTIFICATION OF CABLES AND CABLE CONNECTORS (Con't).

o. **W14 Cable.**



p. **Connection and Disconnection Instructions.**

**WARNING**

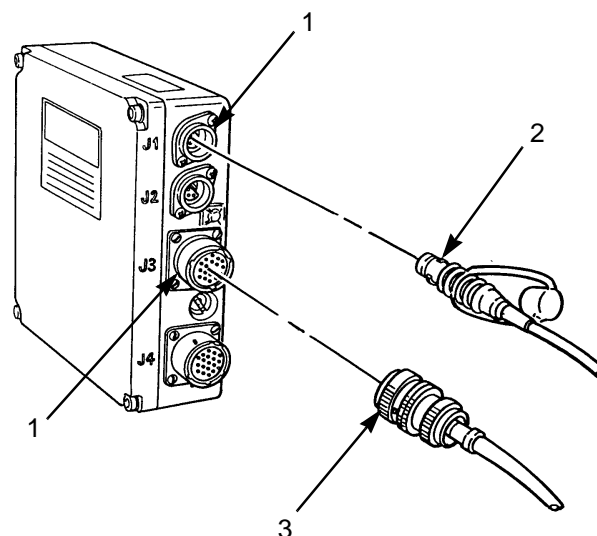
Vehicle MASTER SWITCH and turret power must be OFF before connecting or disconnecting system components/ cables. Failure to follow this warning may cause turret or 25 mm gun movement, resulting in injury or death to personnel.

(1) Align cable connector (2 or 3) with connecting point (1) by aligning:

(a) either the red dot at cable connector (2) with red dot at connecting point, or

(b) the keyway at cable connector (3) with keyway at connecting point.

(2) For cable connectors (3) with knurled collars, rotate collar clockwise to connect. For all other cable connectors (2), push straight in to connect.



**CAUTION**

Any attempt to disconnect a cable connector by pulling only on the cable will damage the cable and cable connector.

(3) To disconnect knurled collar type cable connectors (3), rotate collar counterclockwise to disconnect. For all other cable connectors (2), pull straight out on connector body to disconnect.

## 1-11. OPERATOR'S CONTROLS AND INDICATORS.

a. The PGS control panel (1) provides the means to manually input required system functions, sub-functions, and options; upload ammo; select training modes; operate system during training; align system prior to training; and view results of firing simulations and BIT error messages.

b. The TDRS memory card (3) is placed into a slot in the control panel. The memory card contains vehicle information used to initialize PGS; training data used to set up ammunition amount, training mode, etc.; and training results collected during exercise. After the gunnery training, the memory card is removed from the control panel and an After Action Review (AAR) of training is conducted.

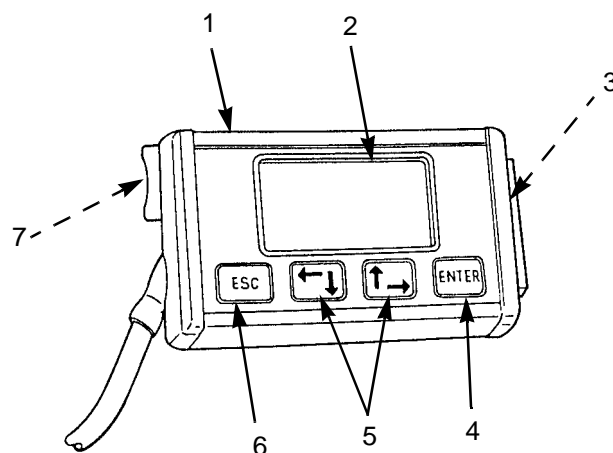
c. The TDRS memory card is ejected from the control panel by pressing eject button (7).

## 1-11. OPERATOR'S CONTROLS AND INDICATORS (Con't).

d. The display screen (2) provides a visual display of functions selected and is a monitor for firing simulation results.

e. The ENTER button (4) is pressed after entering action or function data into the PGS that was previously selected on the display screen.

f. The ESC button (6) is pressed to exit from a current action or function and return to the previous action or function. If ESC button is pressed while an action is being performed, that action will not be saved or performed.



g. Arrow buttons (5) move the cursor up/right and down/left to desired function selection. All functions, sub-functions, and options are abbreviated along the top and left margin of the display screen. When a selection is made, the selection will be lighted and spelled out at the bottom of the screen. Also a triangular shaped highlight will appear next to the function selected when a sub-function is selected.

h. The functions listed below are displayed on the left side of the display screen.

- (1) SI (Simulation)
- (2) AL (Alignment)
- (3) SU (Setup)
- (4) TE (Test)
- (5) CF (Controller Functions)

i. The sub-functions listed below are displayed across the top of the display screen when the corresponding function is selected.

- (1) **SI**
  - (a) RM (Remaining Ammo)
  - (b) GD (Graphics Display)
- (2) **AL**
  - (a) CA (Cant Alignment)
  - (b) LA (Laser Alignment)
  - (c) TG (TBOS Gunner)
  - (d) TC (TBOS Commander)
  - (e) TD (TBOS DIM36TH)
- (3) **SU**
  - (a) BL (Backlight)
  - (b) CO (Contrast)

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**1-11. OPERATOR’S CONTROLS AND INDICATORS (Con’t).**

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- (4) **TE**
  - (a) EL (Error List)
  - (b) BT (Built-In Test)
  - (c) TT (Time Totalizing Meter)
  - (d) DR (Detector Test RDU)
  - (e) DH (Detector Test HDDU)
- (5) **CF**
  - (a) TI (Set Time)
  - (b) AT (Ammunition Turret)
  - (c) AH (Ammunition Hull)
  - (d) SV (Software Versions)
  - (e) DP (Display Position)
  - (f) DA (Display Attribute)

j. The sub-function options listed below are displayed across the top of the display screen when the corresponding sub-function is selected.

- (1) **RM**
  - (a) MW (Main Weapon)
  - (b) CO (Coax)
- (2) **LA**
  - (a) M (Measure)
  - (b) S (Save)
  - (c) R (Reset)
- (3) **TG/TC/TD (TBOS)**
  - (a) AL (Alignment)
  - (b) R (Reset)
- (4) **AT/AH**
  - (a) MW (Main Weapon)
  - (b) CO (Coax)

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**1-12. EQUIPMENT DATA.**

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**PGS:**

Power Requirements .....	21 to 29 V dc
Operational Temperature Range .....	-13°F to +120°F
	(-25°C to +45°C)

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**1-12. EQUIPMENT DATA (Con't).**


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**Transceiver Unit:**

Length .....	14.5 in (36.83 cm)
Diameter .....	4.1 in (10.41 cm)
Weight .....	7 lb 6 oz (3.35 kg)
Range .....	100 to 3750 Meters
Type of Laser .....	GaAs Semiconductor

**Vehicle Interface Unit:**

Length .....	7.1 in (18.03 cm)
Width .....	6.3 in (16.00 cm)
Height .....	2.9 in (7.37 cm)
Weight .....	4 lb (1.82 kg)

**Control Panel:**

Length .....	5.2 in (13.21 cm)
Width .....	3.1 in (7.87 cm)
Height .....	1.6 in (4.06 cm)
Weight .....	1 lb 3 oz (0.54 kg)

**TBOS Driver Unit:**

Length .....	6.3 in (16.00 cm)
Width .....	4.9 in (12.45 cm)
Height .....	1.8 in (4.57 cm)
Weight .....	1 lb 14 oz (0.85 kg)

**Target Computer Unit:**

Length .....	7 in (17.78 cm)
Width .....	6.3 in (16.00 cm)
Height .....	2.1 in (5.33 cm)
Weight .....	2 lb 14 oz (1.30 kg)

**Retro Detector Unit:**

Length .....	3.5 in (8.89 cm)
Width .....	6.7 in (17.02 cm)
Height .....	5.5 in (13.97 cm)
Weight .....	3 lb (1.36 kg)

**Hull Defilade Detector Unit:**

Length .....	2.4 in (6.10 cm)
Width .....	4.0 in (10.16 cm)
Height .....	1.9 in (4.83 cm)
Weight .....	1 lb (0.45 kg)

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**1-12. EQUIPMENT DATA (Con't).**


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**Expansion Unit:**

Length .....	8.5 in (21.59 cm)
Width .....	6.1 in (15.49 cm)
Height .....	3.2 in (8.13 cm)
Weight .....	2 lb 14 oz (1.30 kg)

**TDRS Memory Card:**

Length .....	3.4 in (8.64 cm)
Width .....	2.2 in (5.59 cm)
Thickness .....	0.2 in (5.08 mm)
Weight .....	1 oz (0.03 kg)

**TBOS Eyepiece Unit:**

Length .....	8.2 in (20.83 cm)
Width .....	3.8 in (9.65 cm)
Height .....	2.0 in (5.08 cm)
Weight .....	1 lb 7 oz (0.65 kg)

**Shorting Plug:**

Length .....	2.9 in (7.37 cm)
Diameter .....	2.0 in (5.08 cm)
Weight .....	5 oz (0.14 kg)

**RSI Unit:**

Length .....	6.24 in (15.85 cm)
Width .....	6.24 in (15.85 cm)
Height .....	2.53 in (6.43 cm)
Weight .....	3.5 lb (1.59 kg)

**TBOS Video Mixer:**

Length .....	7.3 in (18.54 cm)
Width .....	6.3 in (16.00 cm)
Height .....	2.9 in (7.37 cm)
Weight .....	4 lb (1.82 kg)

**Retro Reflector Unit:**

Length .....	10.2 in (25.91 cm)
Width .....	4.1 in (10.41 cm)
Height .....	3.3 in (8.38 cm)
Weight .....	2 lb (0.91 kg)

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## 1-12. EQUIPMENT DATA (Con't).

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### Storage Cases:

Length .....	33.5 in. (85.09 cm)
Width .....	33.5 in. (85.09 cm)
Height .....	13.6 in. (34.54 cm)

### Weights:

Case 1 of 2 (Unloaded) .....	38 lb 8 oz (17.5 kg)
Case 1 of 2 (Loaded) .....	83 lb 10 oz (38 kg)
Case 2 of 2 (Unloaded) .....	36 lb 5 oz (16.5 kg)
Case 2 of 2 (Loaded) .....	79 lb 3 oz (36 kg)
Retro Reflector Unit (Unloaded) .....	37 lb 6 oz (17 kg)

